



MU123

Practice quizzes for Units 11 to 14 (Set 1)

Note that the questions in this document are designed for on screen usage via the course website. Some of the instructions within questions may not quite suit this printed version, e.g. when the question refers to 'box below' this should be interpreted as 'box in margin'.

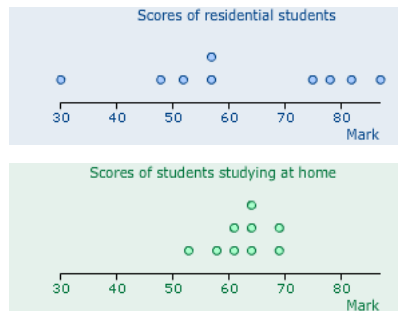
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Unit 11 practice quiz questions

Question 1

The following dotplots represent the scores of two groups of students taking the same mathematics examination. One group studied the course in a residential school while the second studied at home.



Choose the **two** options from the list below that are true.

Options

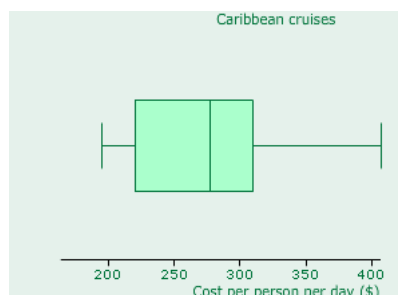
- A** There are exactly five students who studied at home who share their mark with at least one other student who studied at home.
- B** The range of the marks of the residential students is greater than the range of the marks of those who studied at home.
- C** The scores of the students who studied at home are less densely packed about their median than the scores of the residential students.
- D** The median of the scores of the residential students is smaller than the median of those who studied at home.
- E** There are three residential students with the same mark.
- F** The ranges of the two datasets indicate there is more variation in the marks of the students who studied at home than in the marks of the residential students.

Answer:

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Question 2

The following boxplot was drawn from data giving the cost (in US dollars) per person per day of 15 sea cruises from Caribbean liners.



Choose the **one** option from the list below that is true.

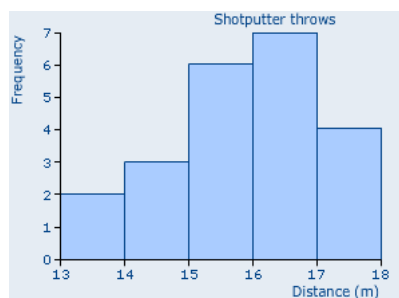
Options

- A The range is smaller than the interquartile range.
- B The median is closer to the upper quartile than the lower quartile.
- C The median is lower than the lower quartile.
- D The median is greater than the upper quartile.

Answer:

Question 3

The following histogram represents the distribution of the distances (in m) of throws by 22 male shot-putters.



Choose the **two** options from the list below that are true.

Options

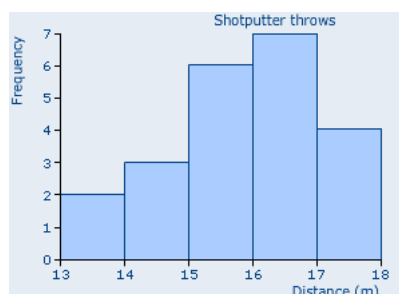
- A There are exactly two intervals in the histogram which contain exactly three data values.
- B There are exactly thirteen data values greater than or equal to 15 m but less than 17 m.
- C The range of the data values is less than 3 m.
- D Exactly four data values are less than 15 m.
- E The data values are more concentrated at the extremes of the histogram than in the middle.
- F The two columns with the lowest frequencies together contain a total of five data values.

Answer:

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Question 4

The following histogram represents the distribution of the distances (in m) of throws by 22 male shot-putters.



Answer:

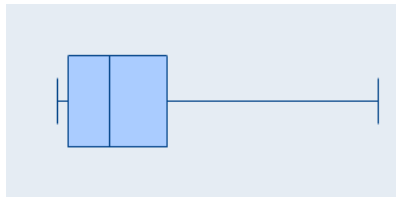
How many shot-putters had a throw of less than 15 m?

(Your answer should be a number.)

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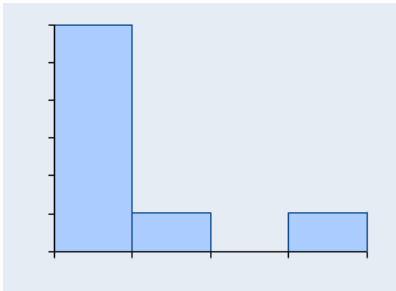
Question 5

Which of the following histograms could represent the same dataset as the boxplot shown below?

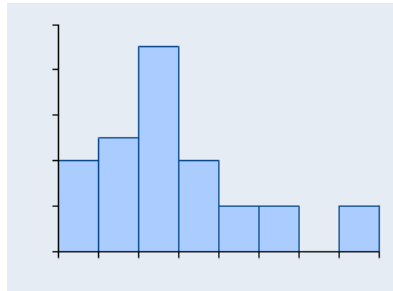


Options

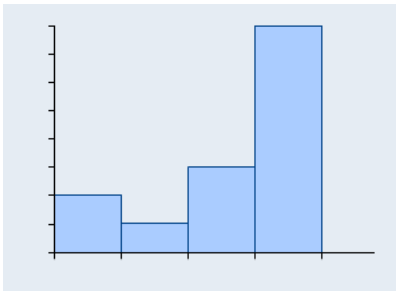
A



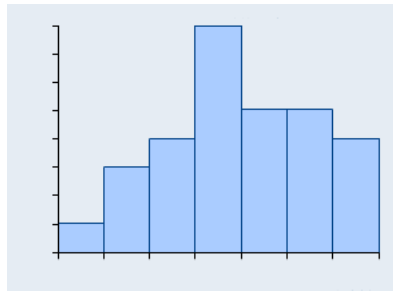
B



C



D



Answer:

Question 6

Consider the following random numbers.

Which number has the highest frequency?

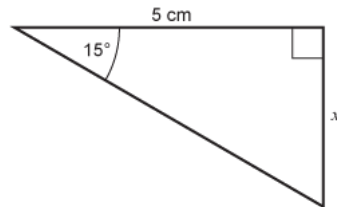
2 3 5 3 3 9 7 1 6 1 4 3 4 6 4

Answer:

Unit 12 practice quiz questions

Question 1

Calculate the length marked x in the following diagram.



Answer:

Enter your answer in centimetres to one decimal place in the box below (without units).

Question 2

The point B is 5 cm in a direction 60° east of north from point A .

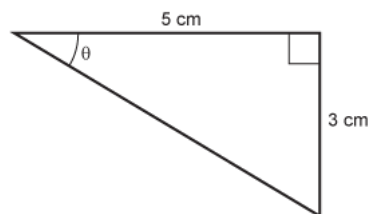
How many centimetres east is point B from point A ?

Enter your answer in centimetres to one decimal place in the box below (without units).

Answer:

Question 3

Calculate the angle marked θ in the following diagram.

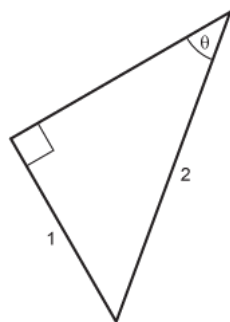


Answer:

Enter your answer in degrees to the nearest degree in the box below (without units).

Question 4

Consider the following triangle (not drawn to scale).



Select the option that is the value of the angle marked θ .

(Hint: you should not need to calculate anything as the given triangle is one of the standard triangles used to calculate useful known values of sine, cosine and tangent.)

Options

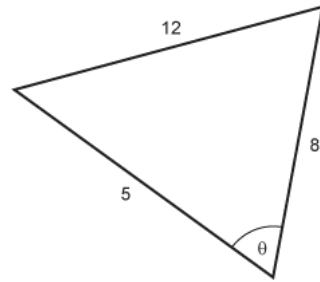
A 0° B 30° C 60° D 45° E 90°

Answer:

Practice quizzes for Units 11 to 14 (Set 1)

Question 5

Calculate the angle marked θ in the following triangle (this triangle has purposely not been drawn to scale).



Answer:

Enter your answer in degrees to the nearest degree in the box below (without units).

Question 6

Select the option that is the quadrant containing the angle 110° .

Options

- A first B second C third D fourth

Answer:

Question 7

By plotting the appropriate point P on the unit circle and using a suitable right-angled triangle, select the option that is equal to $\sin 110^\circ$.

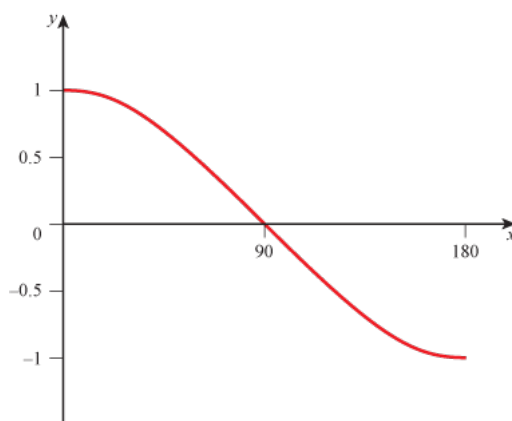
Options

- A $-\sin 20^\circ$ B $-\cos 20^\circ$ C $\sin 20^\circ$ D $\cos 20^\circ$ E $\tan 20^\circ$

Answer:

Question 8

Select the option that could be the function plotted in the following graph.



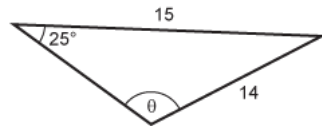
Options

- A tangent B cosine C sine

Answer:

Question 9

Calculate the obtuse angle marked θ in the following triangle (this triangle has purposely not been drawn to scale).



Enter your answer in degrees to the nearest degree in the box below (without units).

Answer:

Question 10

Convert $\frac{1}{18}\pi$ radians to degrees.

Enter your answer in degrees to the nearest degree in the box below (without units).

Answer:

Question 11

Calculate the area of a sector of a circle of radius 3 with angle subtended equal to $\pi/5$ radians.

Enter your answer in the box below to two significant figures.

Answer:

Question 12

Consider a point Q a distance of one unit along the positive x -axis from the origin O .

Consider plotting a point P on a unit circle that corresponds to rotating the point Q by an angle 120° about the point O .

Select the option that gives an angle in radians that would also rotate the point Q to the point P .

Options

- A $\frac{4}{3}\pi$ B $\frac{1}{3}\pi$ C $-\frac{1}{3}\pi$ D $-\frac{4}{3}\pi$ E $-\frac{2}{3}\pi$

Answer:

Unit 13 practice quiz questions

Question 1

A common household bacterium doubles in number every half-hour. If there is one bacterium to begin with, how many will there be 24 hours later?

Options

- A** 3×10^{14} (approximately) **B** 7×10^{15} (approximately) **C** 96
D 48 **E** 1×10^{14} (approximately)

Answer:

Question 2

Choose the correct option from the drop down list for each of the statements below:

The price of a shirt is increased by 34%. To calculate the new price you would need to

The price of a pair of shoes is discounted by 34%. To calculate the new price you would need to

The price of a painting is increased by 34%. To calculate the amount of the increase you would need to

Options

- A** divide the old price by 0.66 **B** multiply the old price by 1.34
C divide the old price by 0.34 **D** divide the old price by 1.34
E multiply the old price by 0.66 **F** multiply the old price by 0.34

Question 3

A car initially costs £11500, and its value depreciates at a rate of 16% per year.

What is its value after 5 years, to the nearest £100?

(Give your answer as a number, without units.)

Answer:

Question 4

A sum of £1400 is invested at a fixed rate of 6.5 percent per year. Assuming there are no further investments or withdraws, by how much will the investment have increased in value after 12 years (to the nearest £1)?

(Give your answer as a number, without units.)

Answer:

Question 5

An investment account guarantees a rate of interest of 3.5 percent per year. How much money (to the nearest £1) would need to be invested to give a total amount of £20000 in 21 years time?

(Give your answer as a number, without units.)

Answer:

Question 6

Drag the words below to correctly complete the following sentence.

The graph of a exponential function is a series of unconnected points, while the graph of a exponential function is smooth in shape. The chessboard problem of Unit 13, Subsection 1.1 is an example of discrete exponential growth where the shape of the graph is a series of points.

Options for all boxes

- A discrete B continuous C unconnected D smooth
E exponential F doubling

Answer:

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Question 7

A bank is advertising a loan which has an interest rate of 2.3%, charged every half year.

What is the annual percentage rate (APR), to two decimal places?

(Give your answer as a number, without the percentage symbol (%).)

Answer:

Question 8

This question concerns the graph of the equation

$$y = ab^x + c,$$

where x and y are variables and a , b and c can be given any numerical value.

Which **one** of the following statements is **true**?

Options

- A The equation has five constants.
B Setting $b = 0$ gives a horizontal straight line $y = a + c$.
C Setting $a = 1$, $b = 2$ and $c = 0$ gives a graph with the line $y = 1$ as an asymptote.
D It is possible to find values for a and b which would turn the equation into a quadratic equation.
E Setting $b = 0$ in the equation gives a horizontal straight line $y = c$.

Answer:

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Question 9

Between which two adjacent integers is the numerical value of $\log_{10}(0.261)$?

Options

- A -2 to -1 B -1 to 0 C -3 to -2 D 1 to 2
E 3 to 4 F 0 to 1 G -4 to -3 H 2 to 3

Answer:

Question 10

What is the value of $\log_4(16)$?

(Give your answer as a number.)

Answer:

Question 11

Use the laws of logarithms to find the value of x such that

$$\log_5 x = 4\log_5 2 + 3\log_5 3 - 2\log_5 6$$

and enter the appropriate value of x in the box below.

(Your answer should be a number.)

Answer:

Question 12

Solve the following equation for t , giving your answer correct to two decimal places.

$$3^t = 10.$$

(Give your answer as a number.)

Answer:

Question 13

A certain population of penguins is thought to be declining by 1.4% per year.

If this rate of decline continues, how long will it be until the population is half of its current size?

Give your answer in years, correct to one decimal place (without units).

Answer:

Question 14

The radioactive half-life of barium-139 is 82.7 minutes.

The radioactivity levels of a sample of barium-139 has been measured to be 69 becquerels.

What will the radioactivity level be 10 minutes later, to the nearest becquerel?

(Give your answer as a number, without units.)

Answer:

Unit 14 practice quiz questions

Question 1

In a town, it is estimated that '1 in 11' households do not have a large television.

What is the chance that a household selected at random does not have a large television?

Enter your answer as a decimal, rounded to 2 significant figures, in the box below.

Answer:

Question 2

Solve the following simultaneous equations:

$$\begin{aligned}y &= x + 1 \\ y &= x^2 - 8x + 9\end{aligned}$$

Choose the two correct options for y .

Options

- A 2 B 9 C 8 D 1
E 0 F -3 G -7 H -6

Answer:

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Question 3

Select the angle between 0 and 2π that has the same cosine as the angle $\frac{\pi}{7}$.

Options

- A $\frac{9\pi}{14}$ B $\frac{8\pi}{7}$ C $\frac{6\pi}{7}$ D $\frac{13\pi}{7}$ E $\frac{19\pi}{14}$

Answer:

Question 4

Calculate the largest angle θ between 0 and 2π for which

$$\sin \theta = 0.75.$$

Enter the largest angle in radians, rounded to three significant figures, in the box below.

(Your answer should be a number, without units.)

Answer:

Question 5

Calculate to the nearest degree the largest angle θ between 0° and 360° for which

$$\cos \theta = -0.901.$$

Round your answer to the nearest degree and enter this rounded answer in the box below.

(Your answer should be a number, without a degree symbol.)

Answer:

Practice quizzes for Units 11 to 14 (Set 1)

Question 6

What is the angle of inclination of the line given by the following equation?

$$y = -\frac{2}{5}x + 3$$

Enter your answer rounded to the nearest degree in the box below.

(Your answer should be a number, without a degree symbol.)

Answer:

Question 7

Select the option that gives the period of the graph of

$$y = \sin\left(\frac{1}{3}x + \frac{\pi}{2}\right) + 9$$

Options

- A $1/3$ B 3π C $\frac{\pi}{2}$ D $\frac{3\pi}{2}$ E 6π

Answer:

Question 8

Select the two options which are correct statements about the equation

$$y = 3 \sin\left(4x - \frac{\pi}{2}\right) + 5$$

Options

- A The graph of $y = 3 \sin\left(4x - \frac{\pi}{2}\right) + 5$ can be obtained by shifting the graph of $y = 3 \sin(4x) + 5$ by $\frac{\pi}{2}$ units to the right.
- B The amplitude is 6.
- C The amplitude is 3.
- D The minimum value of the function is 5.
- E The vertical displacement is 8.
- F The graph of $y = 3 \sin\left(4x - \frac{\pi}{2}\right) + 5$ can be obtained by shifting the graph of $y = 3 \sin(4x) + 5$ by $\frac{\pi}{8}$ units to the right.

Answer:

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Unit 11 practice quiz solutions

Solution 1

Correct option : ☐ B

Correct option : ☐ D

The correct options are:

- The range of the marks of the residential students is greater than the range of the marks of those who studied at home.

The range is the difference between the maximum and minimum values in the dataset. The range of the marks of the students who studied at home is less than 20, and the range of the marks of the residential students is more than 50. The range of the residential students dataset is therefore greater.

- The median of the scores of the residential students is smaller than that of those who studied at home.

The median value is represented by the dot in the middle of the dataset, or half way between the middle two in the case of an even number of data points. The median of the residential students dataset is 57 marks, and the median mark of those who studied at home is 64.

See Unit 11, Subsection 1.1.

Solution 2

Correct option : ☐ B

The correct option is:

- The median is closer to the upper quartile than the lower quartile.
The median is represented by the line in the middle of the box, and the quartiles by the ends of the box. In this case, it can be seen that the median is closer to the right-hand edge of the box.

See Unit 11, Subsection 1.2.

Solution 3

Correct option : ☐ B

Correct option : ☐ F

The correct options are:

- The two columns with the lowest frequencies together contain a total of five data values.
The two columns with the lowest frequencies are the two shortest columns. In this case the shortest columns are those covering the intervals from 13 m up to 14 m (which contains two data values) and from 14 m up to 15 m (containing three data values). Adding the numbers of data values in these columns gives five data values.

- There are exactly thirteen data values greater than or equal to 15 m but less than 17 m.
The number of data values greater than or equal to 15 m but less than 17 m is given by the sum of the heights of the corresponding columns. The columns containing data values greater than or equal to 15 m but less than 17 m are those from 15 m up to 16 m (containing six data values) and from 16 m up to 17 m (containing seven data values). So, the total number of values within the

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columns representing data values greater than or equal to 15 m but less than 17 m is thirteen.

See Unit 11, Section 2.

Solution 4

Correct answer :

In a histogram, the number of values occurring in each interval is represented by the height of the corresponding column.

The number of shot-putters who had a throw of less than 15 m can be found by totalling the heights of the columns corresponding to this. The column corresponding to the interval 13 up to 14m has a height of 2 and that corresponding to 14 up to 15m has a height of 3.

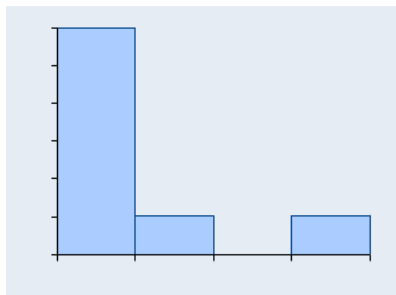
So, the number of shot-putters who had a throw of less than 15 m is $2 + 3 = 5$.

See Unit 11, Section 2.

Solution 5

Correct option :

The correct histogram corresponding to the given boxplot is show below.



The boxplot is divided into four quartiles each containing 25% of the data values. The distance from the minimum to the third quartile is shorter than the right hand whisker. This indicates that approx 75% of the data values are concentrated on the left hand side of the histogram. The length of the left-hand whisker tells you that the highest concentration is on the extreme left-hand side of the histogram.

See Unit 11, Sections 1 and 2.

Solution 6

Correct answer :

By counting the occurrence of each number, or by plotting the data using Dataplotter, the number occurring most often is 3 which occurs four times.

See Unit 11, Subsection 3.2.

Unit 12 practice quiz solutions

Solution 1

Correct answer : 1.3

From the diagram we see that in the right-angled triangle we are given the adjacent side as 5 cm and the required distance x is the opposite side to the given angle. So, remembering SOH CAH TOA, the trigonometric ratio to use is tangent.

So we have

$$\tan 15^\circ = \frac{x}{5}$$

Re-arranging to make x the subject gives

$$x = 5 \tan 15^\circ$$

Using a calculator gives $x = 1.3$ to two significant figures.

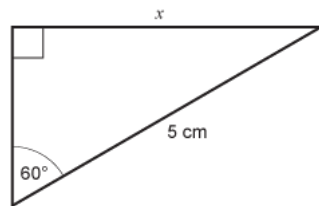
So the required answer is 1.3.

See Unit 12, Subsection 1.2.

Solution 2

Correct answer : 4.3

Start by drawing a diagram.



From the diagram we see that in the right-angled triangle we are given the hypotenuse 5 cm and the required distance is the side opposite to the given angle. So, remembering SOH CAH TOA, the trigonometric ratio to use is sine.

So we have

$$\sin 60^\circ = \frac{x}{5}$$

Multiplying by 5 to make x the subject gives

$$5 \sin 60^\circ = x$$

Using a calculator gives $x = 4.3$ to one decimal place.

So the required answer is 4.3.

See Unit 12, Subsection 1.2.

Solution 3

Correct answer : 31

From the diagram we see that in the right-angled triangle with respect to the required angle θ we are given the adjacent side as 5 cm and the opposite side as 3 cm. So, remembering SOH CAH TOA, the trigonometric ratio to use is tangent.

So we have

$$\tan \theta = \frac{3}{5}$$

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Taking then inverse tangent of both sides gives

$$\theta = \tan^{-1} \left(\frac{3}{5} \right)$$

Using a calculator gives $\theta = 31^\circ$ to the nearest degree.

So the required answer is 31.

See Unit 12, Subsection 1.3.

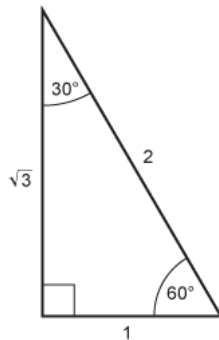
Solution 4

Correct option :

As the hint says the triangle is one of the triangles related to the useful known values of sine, cosine and tangent.

From the given information you should be able to recognise that the triangle as half of an equilateral triangle with sides of length two split by a line from a vertex to the middle of the opposite side.

The full labelling of this triangle is as follows



Comparing the given triangle with the above triangle gives $\theta = 30^\circ$.

See Unit 12, Subsection 1.4.

Solution 5

Correct answer :

This triangle has all three sides given and does not contain right angle, so the method to use is the cosine rule:

$$a^2 = b^2 + c^2 - 2bc \cos A$$

In this formula the angle A is opposite the side a . So in the diagram if the angle A is θ then the side a is 12. The sides b and c are the other two sides, i.e. 5 and 8. Substituting these values into the above formula gives:

$$12^2 = 5^2 + 8^2 - 2 \times 5 \times 8 \times \cos \theta$$

This evaluates to

$$55 = -80 \times \cos \theta$$

So

$$\cos \theta = -0.6875$$

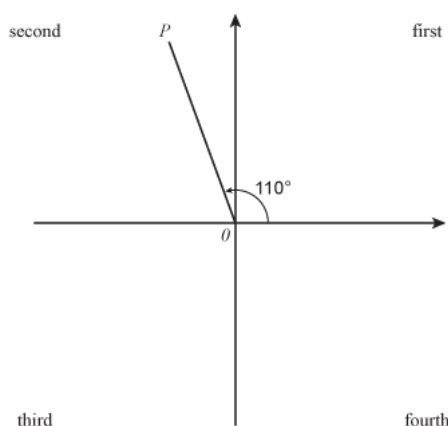
Taking the inverse cosine of both sides gives $\theta = 133^\circ$ to the nearest degree.

See Unit 12, Subsection 2.2.

Solution 6

Correct option :

The first step is to draw a diagram.



From the diagram it can be seen that the angle is in the second quadrant.

See Unit 12, Subsection 3.1.

Solution 7

Correct option : D

The first step is to draw a diagram. The angle 110° lies in the second quadrant, so the corresponding acute angle is:

$$110^\circ - 90^\circ = 20^\circ$$

A diagram with the point P marked is as follows.



The length x marked in the diagram is the magnitude of the sine of 110° . In the acute angled triangle shown the length x is adjacent the acute angle 20° , so $\sin 110^\circ$ is related to the cosine of 20° .

The point P is in the second quadrant so $\sin 110^\circ$ must be positive.

Putting these two facts together gives the answer

$$\sin 110^\circ = \cos 20^\circ$$

See Unit 12, Subsection 3.1.

Solution 8

Correct option : B

Looking at the origin we see that the value of the function is $y = 1$ at $x = 0$. So of the three options the function must be cosine.

So the answer is cosine.

See Unit 12, Subsection 3.2.

Solution 9Correct answer : 153

The triangle has an angle together with the opposite side length given, so it is easiest to use the Sine Rule:

$$\frac{14}{\sin 25^\circ} = \frac{15}{\sin \theta}$$

Rearranging to make $\sin \theta$ the subject gives

$$\begin{aligned}\sin \theta &= \frac{15 \sin 25^\circ}{14} \\ &= 0.452805 \dots\end{aligned}$$

Using a calculator to calculate the inverse sine of both sides gives $\theta = 27^\circ$ to the nearest degree.

However the required angle is an obtuse angle with the same sine, which is calculated as $180^\circ - 27^\circ = 153^\circ$.

So the required answer is 153.

See Unit 12, Subsection 3.3.

Solution 10Correct answer : 10

The conversion factor is $180/\pi$ so the angle in degrees is

$$\begin{aligned}\frac{1}{18}\pi \times \frac{180}{\pi} &= \frac{180}{18} \\ &= 10\end{aligned}$$

So the required angle is 10° .

See Unit 12, Subsection 4.1.

Solution 11Correct answer : 2.8

The formula for the area of a sector of a circle of radius r that subtends an angle of θ radians is $\frac{1}{2}r^2\theta$.

The given data is that $r = 3$ and $\theta = \pi/5$, so the area of the sector is

$$\begin{aligned}\frac{1}{2}r^2\theta &= \frac{1}{2} \times 3^2 \times \frac{\pi}{5} \\ &= 2.82743 \dots\end{aligned}$$

So the required area is 2.8 to two significant figures.

See Unit 12, Subsection 4.2.

Solution 12Correct option : D

The conversion factor from degrees to radians is $\pi/180$, which gives

$$\begin{aligned}\text{angle in radians} &= \frac{\pi}{180} \times 120 \\ &= \frac{2}{3}\pi\end{aligned}$$

This value is an angle in radians that would move the point Q to the point P , but it is not in the given options.

Now remember that rotating through a full circle does not change the final position of the point P .

Going anticlockwise around the circle once corresponds to adding 2π radians.

Adding 2π gives $\frac{8}{3}\pi$, which is also not in the given options.

Going clockwise around the circle once corresponds to subtracting 2π radians.

Subtracting 2π gives $-\frac{4}{3}\pi$, which is in the given options and so is the required answer.

See Unit 12, Subsection 4.1.

Unit 13 practice quiz solutions

Solution 1

Correct option : A

The number of bacteria doubles every half-hour.

In 24 hours there are 48 doublings.

After the first doubling there will be 2 bacteria.

After the second doubling there will be $2 \times 2 = 2^2 = 4$ bacteria.

After the third doubling there will be $2 \times 2 \times 2 = 2^3 = 8$ bacteria.

Continuing this pattern, after 48 doublings there will be $2^{48} = 2.81 \times 10^{14}$ bacteria (to 3 s.f.).

The required answer is thus 3×10^{14} (approximately).

See Unit 13, Subsection 1.1.

Solution 2

Matching pairs:

The price of a shirt is increased by 34%. To calculate the new price you would need to	multiply the old price by 1.34
The price of a pair of shoes is discounted by 34%. To calculate the new price you would need to	multiply the old price by 0.66
The price of a painting is increased by 34%. To calculate the amount of the increase you would need to	multiply the old price by 0.34

- If the price of the shirt increases by 34%, the new price can be found from the old by multiplying by a scale factor of $\frac{100+34}{100} = 1 + \frac{34}{100} = 1.34$.
- If the price of the pair of shoes decreases by 34%, the new price can be found from the old by multiplying by a scale factor of $\frac{100-34}{100} = 1 - \frac{34}{100} = 0.66$.
- If the price of the painting increases by 34%, the increase in price is 34% of the original price, which can be found by multiplying the original price by $\frac{34}{100} = 0.34$.

See Unit 13, Subsection 1.2.

Solution 3

Correct answer : 4800

The value decreases by 16% each year, so at the end of a year it is only worth $(100 - 16)\% = 84\%$ of its value at the start of the year. The value at the end of the year is thus 0.84 of the value at the start.

The value at the end of the first year is 11500×0.84 .

At the end of the second year, the value is $11500 \times 0.84 \times 0.84 = 11500 \times 0.84^2$.

Continuing this pattern, at the end of year 5, the value is thus 11500×0.84^5 , which equals 4809.437338.

To the nearest £100 this is £4800.

See Unit 13, Subsection 1.2.

Solution 4Correct answer :

The investment increases by 6.5% each year, so at the end of a year its value is $1 + \frac{6.5}{100} = 1.065$ multiplied by its value at the start of the year.

So, the value at the end of the first year is 1400×1.065 .

At the end of the second year, the value is $1400 \times 1.065 \times 1.065 = 1400 \times 1.065^2$.

At the end of the third year, the value is $1400 \times 1.065^2 \times 1.065 = 1400 \times 1.065^3$.

At the end of year 12, the value is thus 1400×1.065^{12} , which to the nearest £1 is £2981.

We require the amount of increase, which is £2981 – £1400, i.e., £1581.

See Unit 13, Subsection 1.2.

Solution 5Correct answer :

The investment increases by 3.5% each year, so at the end of a year its value is $1 + \frac{3.5}{100} = 1.035$ multiplied by its value at the start of the year.

Suppose the initial investment was £ i .

At the end of the first year it would be worth $i \times 1.035$.

At the end of the second year, the value would be $i \times 1.035 \times 1.035 = i \times 1.035^2$.

Following this pattern, at the end of year 21, the value would thus be $i \times 1.035^{21}$. We need this to be equal to £20000.

So, $i \times 1.035^{21} = 20000$ or, dividing both sides by 1.035^{21} ,

$$i = \frac{20000}{1.035^{21}} = 9711.418057$$

So, to the nearest £1, the amount to be invested is £9711.

See Unit 13, Subsection 1.2.

Solution 6Correct option for box 1: Correct option for box 2: Correct option for box 3:

The correct answer is

The graph of a **discrete** exponential function is a series of unconnected points, while the graph of a **continuous** exponential function is smooth in shape. The chessboard problem of Unit 13, Subsection 1.1 is an example of discrete exponential growth where the shape of the graph is a series of **unconnected** points.

See Unit 11, Subsection 1.3.

Solution 7Correct answer :

The interest rate of 2.3%, each half year corresponds to a half yearly scale factor of 1.023.

This is applied twice a year, so the yearly scale factor is $1.023^2 = 1.04653$.

Practice quizzes for Units 11 to 14 (Set 1)

This corresponds to a yearly interest rate of 4.65% (to two decimal places), so the APR is 4.65%.

See Unit 13, Subsection 2.2.

Solution 8

Correct option :

The correct option is:

- Setting $b = 0$ in the equation gives a horizontal straight line $y = c$.
This is because setting $b = 0$ means $b^x = 0$ so the equation becomes $y = a \times 0 + c$ or $y = c$.

The remaining options were incorrect:

- Setting $b = 0$ gives a horizontal straight line $y = a + c$.
This is incorrect since setting $b = 0$ would mean $b^x = 0$ giving the line $y = c$.
- It is possible to find values for a and b which would turn the equation into a quadratic equation.
This is not true. A quadratic equation needs to have a term in x^2 , but no values of a and b can produce this term.
- The equation has five constants.
Only a , b and c are constants.
- Setting $a = 1$, $b = 2$ and $c = 0$ gives a graph with the line $y = 1$ as an asymptote.
These settings give the equation $y = 2^x$ which has $y = 0$ as an asymptote.

See Unit 13, Section 3.

Solution 9

Correct option :

The number 0.261 lies between 0.10 (i.e. 10^{-1}) and 1 (i.e. 10^0).

The logarithm (to base 10) of 0.261 thus lies between -1 and 0 .

See Unit 13, Subsection 4.2.

Solution 10

Correct answer :

The number 16 can be written as 4^2 , to the logarithm to base 4 of 16 is 2.

See Unit 13, Subsection 4.4.

Solution 11

Correct answer :

Using the rule for the logarithm of a power of a number, $\log_b x^n = n \log_b x$, we can write

$$4 \log_5 2 + 3 \log_5 3 - 2 \log_5 6 = \log_5 2^4 + \log_5 3^3 - \log_5 6^2.$$

The rules for the addition and subtraction of logarithms, $\log_b x + \log_b y = \log_b(xy)$ and $\log_b x - \log_b y = \log_b(\frac{x}{y})$, then allow us to write

$$\log_5 2^4 + \log_5 3^3 - \log_5 6^2 = \log_5 \left(\frac{2^4 3^3}{6^2} \right).$$

So $x = \frac{2^4 3^3}{6^2}$, or simply 12.

See Unit 13, Subsection 5.1.

Solution 12Correct answer : 2.10The equation to solve is $3^t = 10$.Taking logs to base 10 of both sides: $\log_{10}(3^t) = \log_{10}(10)$.Using the fact that $\log_b(x^n) = n \log_b x$, we can write $\log_{10}(3^t) = t \log_{10}(3)$, so the equation becomes

$$t \log_{10}(3) = \log_{10}(10).$$

Hence, dividing both sides by $\log_{10}(3)$: $t = \frac{\log_{10}(10)}{\log_{10}(3)} = 2.095903274$.

Rounding to two decimal places gives 2.10.

See Unit 13, Subsection 5.2

Solution 13Correct answer : 49.2

If the population reduces by 1.4% each year, then the scale factor is

$$\frac{100-1.4}{100} = 1 - \frac{1.4}{100} = 0.986.$$

So, at the end of each year the population is 0.986 of that at the start of the year.

At the end of the first year, the population will be 0.986 of the current population.

At the end of the second year, the population will be 0.986^2 of the current population.At the end of the third year, the population will be 0.986^3 of the current population.Following this pattern, at the end of year t , the population will be 0.986^t of the current population.

We need to find the time taken for the population to halve, so we need to solve

$$0.986^t = \frac{1}{2}$$

Taking logs to base 10 of both sides gives

$$\log_{10}(0.986^t) = \log_{10}\left(\frac{1}{2}\right).$$

Using the fact that $\log_b(x^n) = n \log_b x$, we can write $\log_{10}(0.986^t) = t \log_{10}(0.986)$, so the equation becomes

$$t \log_{10}(0.986) = \log_{10}\left(\frac{1}{2}\right).$$

Hence, dividing both sides by $\log_{10}(0.986)$:

$$t = \frac{\log_{10}\left(\frac{1}{2}\right)}{\log_{10}(0.986)} = 49.16312492.$$

Rounding to one decimal place gives 49.2 years.

See Unit 13, Subsection 5.3

Solution 14Correct answer : 63If the level of radioactivity reduced by a scale factor of s every minute, then the half-life, i is given by

$$s^i = 0.5.$$

In this case we are given that $i = 82.7$, so $s^{82.7} = 0.5$.This can be solved to find the scale factor, s . Taking the 82.7th root of both sides gives

Practice quizzes for Units 11 to 14 (Set 1)

$s = \sqrt[82.7]{0.5}$, which can also be written as $s = 0.5^{\frac{1}{82.7}}$.

Evaluating this gives the scale factor, $s = 0.9916535613$.

If level of radioactivity reduces by this each minute.

Initially, the level is 69 becquerels.

After the first minute, the level of radioactivity will be 69×0.9916535613 .

After the second minute, the level of radioactivity will be 69×0.9916535613^2 .

So, after 10 minutes, the level of radioactivity will be
 $69 \times 0.9916535613^{10} = 63.45251634$.

To the nearest becquerel, this is 63 becquerels.

See Unit 13, Subsection 5.3

Unit 14 practice quiz solutions

Solution 1

Correct answer :

The chance is '1 in 11', that is $1/11 = 0.091$ to two significant figures.

See Unit 14, Subsection 1.1.

Solution 2

Correct option :

Correct option :

Equating the expressions for y gives:

$$x + 1 = x^2 - 8x + 9$$

Rearrange:

$$0 = x^2 - 9x + 8$$

Factorise:

$$0 = (x - 1)(x - 8)$$

Hence $x = 1$ or $x = 8$.

To find the corresponding y values substitute these values of x into the first equation.

When $x = 1$,

$$y = 1 + 1 = 2.$$

When $x = 8$,

$$y = 8 + 1 = 9.$$

So the two solutions for y are 2 and 9.

See Unit 14, Subsection 2.1.

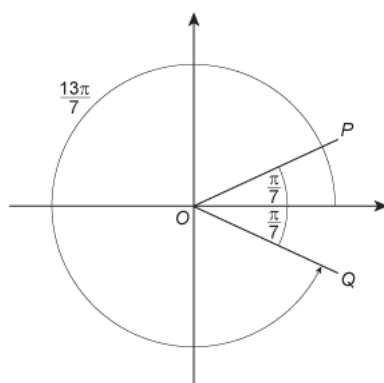
Solution 3

Correct option :

The angle $\frac{\pi}{7}$ lies in the first quadrant.

So the cosine is positive and the required angle lies in the fourth quadrant.

Now draw a diagram to determine the related angles.



In the diagram the angle between the positive horizontal axis and OP is $\frac{\pi}{7}$.

Practice quizzes for Units 11 to 14 (Set 1)

The angle with the same cosine is the angle to the line OQ , where Q lies on a vertical line with P .

The related angle in the fourth quadrant is $2\pi - \frac{\pi}{7} = \frac{13\pi}{7}$, and this is the required answer.

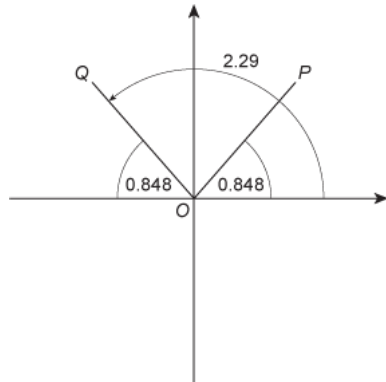
See Unit 14, Subsections 2.2 and 2.4.

Solution 4

Correct answer : 2.29

The sine of θ is positive, so θ lies in the first and second quadrants.

The related acute angle is given by $\sin^{-1}(0.75) = 0.848\dots$



So from the related angles diagram, the two angles are 0.848 and $\pi - 0.848 = 2.29$ (to three significant figures).

The answer is the larger of these two solutions: 2.29 .

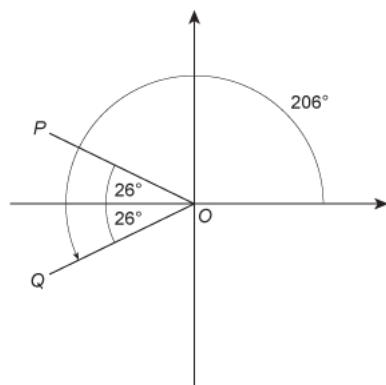
See Unit 14, Subsections 2.2, 2.4 and 2.5.

Solution 5

Correct answer : 206

The cosine of θ is negative, so θ lies in the second and third quadrants.

The related acute angle is given by $\cos^{-1}(0.901)$, which is 26° to the nearest degree.



So from the related angles diagram, the two angles are $180^\circ - 26^\circ = 154^\circ$ and $180^\circ + 26^\circ = 206^\circ$.

So the larger angle is 206° and the answer is 206 .

See Unit 14, Subsection 2.2.

Solution 6

Correct answer : 158

The gradient of the line is $-2/5$.

So, if θ is the angle of inclination, then $\tan \theta = -2/5$.

By definition the angle of inclination, θ , lies between 0° and 180° .

Since $\tan \theta$ is negative then we expect θ to be obtuse.

Performing the calculation gives $\tan^{-1}(-2/5) = 158^\circ$ (to the nearest degree), which is indeed obtuse.

Hence the angle of inclination is 158° and the answer is 158.

See Unit 14, Subsection 2.3.

Solution 7

Correct option : E

For the general sine function $y = a \sin(b(x - c)) + d$ the period is given by $\frac{2\pi}{|b|}$.

For the given function $b = \frac{1}{3}$, so the period is

$$\frac{2\pi}{|\frac{1}{3}|} = 6\pi.$$

So the answer is 6π .

See Unit 14, Subsection 4.2.

Solution 8

Correct option : C

Correct option : F

The general sine function $y = a \sin(b(x - c)) + d$ where $a > 0$, has the following properties:

- the amplitude is given by a ;
- c is the horizontal displacement;
- d is the vertical displacement;
- the period is given by $\frac{2\pi}{|b|}$.

The function

$$y = 3 \sin\left(4x - \frac{\pi}{2}\right) + 5$$

can be rearranged as

$$y = 3 \sin\left(4\left(x - \frac{\pi}{8}\right)\right) + 5,$$

so $a = 3$, $b = 4$, $c = -\frac{\pi}{8}$ and $d = 5$.

Hence the amplitude is 3, the horizontal displacement is $\frac{\pi}{8}$ units to the right, and the vertical displacement is 5.

The minimum value is given by $d - a = 5 - 3 = 2$.

So the correct options are:

- The amplitude is 3.
- The graph of $y = 3 \sin\left(4x - \frac{\pi}{2}\right) + 5$ can be obtained by shifting the graph of $y = 3 \sin(4x) + 5$ by $\frac{\pi}{8}$ units to the right.

See Unit 14, Subsection 4.2.